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Review Paper

Economic Efficiency of Public Administration in the Field of Digital Development

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ABSTRACT

In the article, based on the analysis of the essential characteristics of digitalization, it is proposed to consider the concept of efficiency in relation to the activities of public authorities as a generalized and interconnected series of such concepts as economy, qualimetricity, and effectiveness. The efficiency of public administration, including economic efficiency, is considered as the implementation of management, during which the set goals are achieved (solving a certain socially significant problem, satisfying the interests of the population, maintaining digital competitiveness of region and country) while minimizing costs and observing the current standards of digital maturity. It is proposed to understand the assessment of the effectiveness of public administration as a set of methods for measuring actual indicators that reflect the results of the public authorities' activities within the framework of the strategies, programs, and projects being implemented in accordance with the criteria laid down in them, and in this case the assessment is seen as the direct result of such a measurement, which serves to compare the activities of public administration subjects, compare this activity with the declared goals, the results of past periods. The proposed leading and signal indicators can be used in planning and forecasting the level of digital development of regional socio-economic systems.

HIGHLIGHTS

- The article is devoted to the analysis of approaches to assessment of the economic efficiency of public administration in the field of digital development, based on the paradigm of digital transformation
- The obtained results demonstrated the necessity of rethinking methodology for evaluating the economic efficiency of public administration in changed landscape of digital economy and digital society
- The practical significance of the research lies in suggesting assessment of the economic efficiency of public administration in the field of digital development based on methodology for assessing the level of digital development, including leading (early) and signal indicators, that would allow obtaining prospective assessment and take into account heterogeneity of regional digital development

Keywords: Public administration, Economic efficiency, Digital development, Digital transformation, Digital maturity

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A large number of specific transformations of information into digital form leads to such significant positive consequences that determine the use of the term "digitalization" in a broad sense: as a transition of all aspects of economic and social life to digital information. Digitalization is turning from a simple method of improving various private aspects of life into a driver of global social development. The great possibilities of digital representation of information lead to the fact that digitalization already forms integral technological "habitats" (ecosystems, platforms), within which the user can create for himself the friendly environment he needs (technological, instrumental, methodological, documentary, partner, etc.) in order to solve entire classes of problems.

Therefore, digitalization in a broad sense is understood as a modern global trend in the development of the economy and society, which is based on the transformation of information into digital form and leads to an increase in the efficiency of the economy and an improvement in the quality of life of people by increasing the speed of interchange, accessibility and security of information, as well as increasing the role of automation as digitalization bases (Wierzbik-Strońska and Nestorenko, 2021).

However, it should be noted that digitalization can be considered as a trend of effective global development only if the digital transformation of information meets the following requirements: it covers production, business, science, the social sphere and everyday life of citizens; accompanied only by the effective use of its results; its results are available to users of the transformed information; its results are used not only by specialists, but also by ordinary citizens; users of digital information have the skills to work with it (Morze and Strutynska, 2021).

In the era of global digitalization, the state and its institutions are faced with an objective need to get involved in this process, since it affects almost all spheres of society's life and has a direct impact on the formation of a new type of society – digital one.

Digitalization is one of the main directions in the development of the modern economy, its implementation is associated with the introduction of innovative digital technologies into the practice of work and business, as well as public administration, and into the everyday life of people, i.e., digitalization is one of the forms of innovative development, it is closely connected with the transition to the next technological and world economic order (Arivazhagan *et al.* 2023). The realities of digitalization and digital transformation predetermine the need for countries and their regions to draw out new programs and strategies for the development of society and the economy, in view of the fact that digitalization leads to a new format of relationships, production, and the needs of society, since end-to-end digital technologies lead to qualitative changes in the old foundations and typical formats of activities at all levels of government. Just like informatization and automation, digitalization, by the definition of J. Naisbitt, is a megatrend in the development of the economy, which is based on cybernetic methods and management tools, Big Data analysis tools and artificial intelligence (Naisbitt as cited in Cholan, 2021).

The digital economy is formed on the basis of digitalization and has its own specifics, determined by the nature of creating added value by increasing and systematizing digital content (object of labor), increasing the intellectualization of its processing algorithms automatically (without human intervention and with increasing consideration of the nonlinearity of real processes) and depending on external environment signals (Deyneha *et al.* 2016; Byrkovych *et al.* 2023). One of the key characteristics of the digital economy is the speed of changes in the production of goods and services, in applied business models and management.

Today, many countries consider digitalization as one of the priority areas for the development of their socio-economic systems. Enormous amounts are being spent on innovation and related digital solutions: nearly $2 trillion (purchasing power parity) according to the UNESCO Institute for Statistics. Nearly 47% of these spending are in the US, China, and Singapore, and 80% in the top ten countries in the ranking. China is getting closer to leadership (the country is increasing both the total amount of spending on research and development, and their share in GDP), and such large developing countries as Turkey and India are among the top 40 countries in terms of innovation development (OECD Digital Economy Outlook 2020). Fig. 1

shows the amount of actual and forecasted spending on digital transformation technologies and services worldwide from 2017 to 2026.

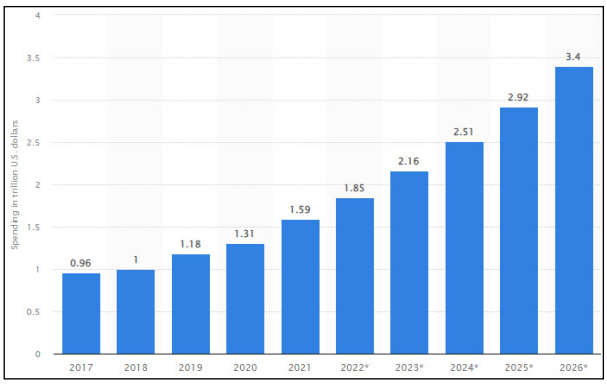

Fig. 1: Spending on digital transformation technologies and services worldwide from 2017 to 2026 (in trillion U.S. dollars) (Statista, 2023)

According to the chart data, in 2022, spending on digital transformation (DX) is projected to reach 1.6 trillion U.S. dollars. By 2026, global digital transformation spending is forecast to reach 3.4 trillion U.S. dollars (Statista, 2023).

The implications of digitalization in Europe in societal plane can be traced on Fig. 2.

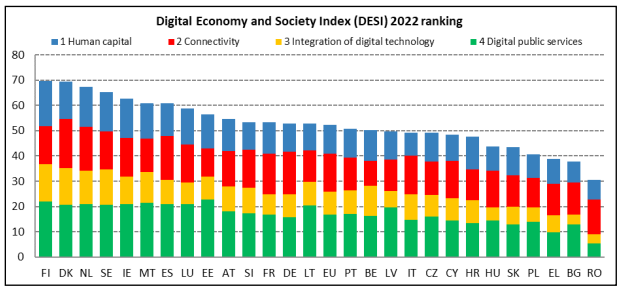

Fig. 2: Digitalization in Europe, by country (Jones, 2022)

It is obvious that such a pace of digitalization implies an appropriate modification of the principles and tools of public management of these processes, taking into account economic efficiency.

MATERIALS AND METHODS

The theoretical and methodological basis of the study includes the theoretical and experimental provisions of economic theory, the science of the principles and methods of management, the theory of economics based on digital technologies, the theory of innovative and strategic management, the theory of analysis and forecasting.

In the course of work, research methods of analysis and synthesis, a logical method of scientific reproduction of the development of a complex object, a systematic approach were used, which allow considering the digital transformation of the economy and appropriate public administration as a system, highlighting the features, properties, directions, regulatory practice, making it possible to identify its role and significance.

LITERATURE REVIEW

The literature notes that digital development management represents the application of methods and tools for strategic, tactical, and operational management of the introduction and development of digital technologies, services, and infrastructure (Matvejciuk, 2019). In this regard, as a common rule, the national program for the development of the digital economy seeks to formulate development directions for the formation and maintenance of the most favorable organizational, infrastructural, and regulatory characteristics of the national digital jurisdiction for business development in the new economic order, as well as the advanced development of national institutions of digital economy (Ndulu *et al.* 2023).

At the same time, development programs usually implement a regulatory approach that assumes that non-prohibitive regulation should be followed at the stage of formation of new institutions of the digital economy, in order to avoid erecting unreasonable administrative barriers to the modernization of domestic manufacturing and service industries (Ndulu *et al.* 2023). Regulatory measures characteristic of the traditional economic structure will not always be effective in a global virtual digital environment and may create difficulties for national businesses and (or) citizens to enter and fully participate in the processes of the digital economy, thereby providing advantages to representatives of foreign jurisdictions.

An important aspect of the digital economy' functioning is also to ensure the information and economic security of the state and business, the protection of personal data and the privacy of citizens in the digital space.

In the digital economy, data is becoming a form of capital (Gaman *et al.* 2022; Gavkalova *et al.* 2022). The formation, accumulation, and use of this kind of

capital require close cooperation between the state and business, the state and civil society, business and civil society.

However, economic benefits are received by those states and economic entities that have not only access to data, but also effective technologies for processing them. Qualitative economic growth is possible with the availability of technologies that make it possible to assess the current state of markets and industries as accurately as possible, as well as effectively predict their development and quickly respond to changes in the national and world market conditions (Chaliuk, 2020).

At the same time, the economic efficiency of public administration is defined as the ratio of the cost of the volume of services provided to the cost of the volume of resources attracted for this purpose (Alfonso *et al.* 2023). It reflects the internal state of affairs in the public administration system, its own activities.

Experts emphasize that the digital transformation of public administration itself contributes to a qualitative leap in all spheres of human life, and digital technologies are changing the configuration of the global economic space (Gupta *et al.* 2021; Humenchuk *et al.* 2023). The use of "digital technologies" in public administration is built on radical changes, the trajectory of breakthrough developments in the "digital" world. Tools that help people communicate through social networks, cloud technologies, and big data processing and analysis technologies are flourishing (Laitsou *et al.* 2020).

It should be noted that in studies of regional dynamics and economic transformation in the process of ICT diffusion, two contradictory trends are distinguished: on the one hand, the increasing spatial distribution of industries in the global space (dispersion by stages), on the other hand an increase in spatial concentration in industries based on ICT due to the human capital formed in the region, the level of its knowledge and digital competencies (Kalyayev *et al.* 2019; Gupta *et al.* 2021). Therefore, there is a significant difference between countries and regions regarding the role of ICT in their socio-economic development, the ability to perceive (adopt) ICT products. This confirms the need to consider the concept of digital development from the point of view of both the depth of ICT penetration into economic activity and society, and their spatial prevalence (Banhidi *et al.* 2020).

The essence of development consists in such a movement and change in nature and society, which contributes to the transition from one quality of the state to another, from the old to the new (Klymenko *et al.* 2016; Karpa *et al.* 2021). Development is most often understood as five essential categories: an increase in the complexity of the system, an improvement in adaptability to external conditions (for example, the development of an organism); increase in the scale of the phenomenon (e.g., ICT development); quantitative growth of the economy and qualitative improvement of its structure; social progress. Since digital development covers both economic and social objects and phenomena, its essence includes all of the above categories.

Thus, digital development should be understood as fundamental changes in the technological structure in society, consisting in an increase in the complexity and interconnectedness of the socio-economic system based on the growth of the scale and depth of ICT penetration into production and social life of people, which contribute to economic growth, qualitative improvement of production factors, resource efficiency and social progress (Khomiuk *et al.* 2020; Kryshtanovych *et al.* 2022). As a result of digital development, there is a transition from a post-industrial society to an information society through the formation of a digital economy of a harmonious society during the sequence of stages of infocommunication development (Cholan, 2021). At each stage, different tasks are solved and different goals and criteria are used, however, at any stage, the need to ensure the economic efficiency of public administration in the field of digital development remains obvious.

The analysis of the effectiveness of public administration requires the determination, on the one hand, of a clear relationship between the activities of civil servants and the effectiveness of their work, and, on the other hand, an equally clear justification of the amount of expenditure on public administration and the amount of economic return from the introduction of new services and technologies (Kulikov *et al.* 2022; Kussainov *et al.* 2023). The unresolved nature of these issues leads to inefficient use of resources, incomplete realization of the possibilities of the country's socio-economic

development, and an insufficient degree of public confidence in state institutions.

The economic essence of the concept of "efficiency" is widely known to the world community. The ratio of the effect obtained to the cost of obtaining it has been widely used in many branches of science and spheres of life for many decades (Kyrychenko *et al.* 2022; Levytska *et al.* 2022). In economic science, efficiency is understood as the relative effect, the effectiveness of a process, operation, project, defined as the ratio of the effect, result to the costs, expenses that caused, ensured its receipt. However, the direct use of this approach to determine the effectiveness of public services, especially in digital environment, causes many difficulties and nuances (Filgueiras and Almeida, 2021).

The difficulty lies primarily in the intangible result, since it is not enough to determine its usefulness. It is necessary that a public service be of high quality, in other words, have a set of properties that determine its ability to satisfy the needs and demands of consumers, meet its purpose and set requirements (Litvinova *et al.* 2020; Maksymenko *et al.* 2020). Accordingly, the effectiveness of a public service is the receipt of a useful intangible result of activity that meets the needs of the population of the territory and satisfies the requirements for the service.

At the same time, in the implementation of public services, their effectiveness is linked to the efficiency of spending budget funds, which is far from obtaining a positive result. A shift in focus to the efficiency of the use of budget funds in the provision of public services leads to a lack of social impact (Filgueiras and Almeida, 2021).

However, there is no doubt that the public service should be, on the one hand, efficient, and on the other hand, as little as possible budgetary funds should be spent on it.

RESULTS

As the analysis of international and different national indicators of infocommunication development in various countries shows, active and purposeful work in public administration is necessary to ensure the processes of digital transformation of the sectors of the economy and society (Arundel *et al.* 2019):

- On bringing the infocommunication infrastructure in terms of full availability of communication facilities, high-quality bandwidth (volumes and speed), stability and security of information transfer, territorial proportionality of the development of ICT and networks (including rural areas, hard-to-reach and remote regions) to the requirements of subjects and institutions of the digital economy;
- On the transfer of all sectors (branches) of the economy from local digital platforms to integral intersectoral digital platforms, to the electronic form of providing services and performing part of production functions, taking into account the development of non-digital production factors;
- On creation of a single information space for the production of goods and services, the implementation of public administration and social life on the basis of the integration of industry and departmental solutions, the integration and globalization of business, the formation of a single platform with an integrated database.

Assessment of the state and potential of the digital development of the economy and society in the context of sectors of the economy, regions of the country, countries of the world community, comparison of the achieved results of ongoing processes with indicators and targets serve as a quantitative basis for the development of management decisions to implement the strategy for the development of the digital economy of the information society, taking into account the infocommunication component, sequence and scale of digital development, determination of measures to intensify the process and priority areas for investing in national and regional projects for the digitalization of the economy and social sphere.

In world practice, there has not been any universal methodology for assessing the effectiveness of public administration and public service (Panasiuk *et al.* 2020; Novak *et al.* 2022). To monitor and evaluate the effectiveness and efficiency of public authorities in practice of various countries, platform solutions are often used, especially in terms of monitoring and evaluating the quality of public services.

For example, the UK government's performance platform ("Predictive") presents the values of indicators characterizing the provision of public services. Each service is evaluated based on four metrics: (1) average transaction cost; (2) the proportion of applicants who successfully received a service outcome; (3) the total number of citizens applying for the service; (4) the level of digitalization (Wierzbik-Strońska and Nestorenko, 2021).

It is noteworthy that similar indicators are also used to measure the delivery of public services on the performance platform in Australia. The United States also uses special software (USA Performance) to evaluate the performance of federal civil servants (Hong *et al.* 2022).

An interesting assessment methodology was proposed by the Higher School of Urban Studies. There, the authors divided the criteria for assessing the digitalization of small and medium-sized cities into three main blocks: the human factor, the service economy, mobility and potential effect (Novak-Kalyayeva *et al.* 2018; Panasiuk *et al.* 2021). The first block includes: the share of citizens receiving distance education (on-line courses and training via the Internet); share of citizens who received online medical services for the year; increasing the level of trust in others and institutions; share of citizens who regularly use online public services. The second group consists of the following elements: the share of small and medium-sized businesses focused on the local market in the overall structure of the city's economy; share of workers employed in the ICT sector; available services; the development of the leisure sector online. The third group of indicators includes: the number of trips to neighboring cities using online taxi services, tourist flow (including intra-regional), etc. (Sagarik, 2023). An integrated approach to the analysis criteria makes it possible to evaluate those parameters that initially do not involve quantitative measurement, do not have units of measurement and are not covered by monitoring, but become important when they are comprehensively correlated with other metric data.

In addition, the economic efficiency of public administration in the field of digitalization and digital development as whole is also determined by general economic effects, including those based on the theory of agents (Vahonova *et al.* 2014; Troschinsky *et al.* 2020). The main digital agents are the state, business, and society. Table 1 reflects the impact of digital technologies on agents. Thus, in particular, through the introduction of digital technologies, the efficiency of business processes is increased (the use of modern analytical programs helps to manage capital more efficiently, financial and technical reporting is automated, online documentation is maintained, quality monitoring is carried out, etc.); for society, technologies allow increasing labor productivity, for example, through participation in the sharing economy and the possibility of remote work; for the state, digital technologies have the potential to increase the efficiency of routine processes and increase the involvement of the population (Vahonova *et al.* 2014; Yermachenko *et al.* 2023). The innovative potential inherent in digital services can lead to increased competition among companies operating in the field of e-commerce, thus it positively affects the well-being of consumers; in turn, the use of the e-voting system can attract more people and thus make the electoral system more transparent. The integration of digital services into many business areas both helps each company expand its presence in local markets and facilitates easier entry into new interregional and international markets. Thus, the beneficiaries of the introduction of the digital economy also become economic agents of its implementation (Hong *et al.* 2022).

The methods of measuring the quality and efficiency of state and municipal administrations that have been tested and have already proven their viability include the Common Assessment Framework

Table 1: Impact of digital technologies on economic agents

Agent	**Integration**	**Efficiency**	**Innovation**
Companies	Trade	Use of capital	Competition
Population	Employment Opportunities	Labor productivity	Consumer welfare
State	Participation	Development potential of the public sector	Voting right

(CAF), which is common in the states of Western and Central Europe. This technique was developed as a result of close cooperation of the EU member states in the late 90s of the 20th century on the basis of the concept of Total Quality Management widely used in the private and public sectors. The main purpose of the Common Evaluation Framework is to develop an easy-to-use performance and quality evaluation methodology that can be used for internal organizational self-evaluation. This goal is concretized in a number of fundamental tasks. The overall assessment structure should (Alfonso *et al.* 2023):

1. Serve as a preliminary tool for self-assessment (testing) of the effectiveness of the management of organizations within the framework of a more general quality management strategy;
2. Promote comparative studies of efficiency in the public sector;
3. Provide a kind of bridge between the various uses of quality management in the administrative policy of the EU countries.

According to the stated goal and objectives, CAF is based on two key principles (Alfonso *et al.* 2023):

1. Compatibility with various organizational models of public administrations.
2. Applicability for assessing the specifics of the quality of work of public sector organizations.

At the same time, the cyclicality determines not a one-time, but a regular nature of the assessment, making it a mandatory and permanent element of the management system.

Meanwhile, for the correct methodological justification of the system of indicators for assessing the state and potential of the digital development of the economy and society, it is necessary to rely not only on the goals, objectives, and criteria of digital development, taking into account the stages and patterns of the formation of the information society, but also on the methodological principles of bringing together a set of digital parameters into a complex development indicator (Zilinska *et al.* 2022). The advantages of the method of integral assessment of the state and potential of digital development are that it reflects the essence of an integrated, multidimensional approach to assessing a complex, dynamic open system for the development of the digital economy and society; it is carried out on the basis of statistical reporting data, gives a comprehensive description on a temporal and spatial scale with the identification of reserves and bottlenecks for digitalization objects, which makes it possible to specify the directions of digital development by sectors of the economy and regions of the country. The construction of an integral assessment of digital development is based on the principles of goal setting, defining tasks, methods and scales for measuring indicators that reflect the main properties of the process under study. The system of digital development indicators is intended not only for a comprehensive assessment of the state and dynamics of changes in objects and subjects of digitalization, but also for the 'designing' of management decisions to ensure the harmonious development of economic sectors and the proportionality of the development of the country's regions in order to form a single digital space.

DISCUSSION

Evaluation of the effectiveness of public administration is an independent complex problem for the theory of public administration. The complexity of this problem is predetermined, firstly, by the lack of a single indicator of results in the public sector, which is usually profit in the private sector, and, secondly, by the fact that "the output of public sector organizations is usually difficult to measure and not intended for competition" (Hanna, 2016). Under these conditions, it is quite difficult to find performance indicators that meet the ideal requirements of richness, comparability, clarity, controllability, breadth, unboundedness, significance, and accessibility. Nevertheless, by now quite a lot of different methods for measuring efficiency have been created and tested, in which their creators have tried to overcome the above mentioned disadvantages.

A comprehensive methodology for assessing the effectiveness of the public administration system and the quality of public services was developed by the staff of the Campbell Institute of Public Administration (USA) (http://www.maxwell.

syr.edu/gpp/about/index.asp). Since 1996, this methodology has been used to evaluate the performance of all states, the 35 largest US cities, and 40 large counties. This methodology is aimed at assessing the effectiveness of public administration in the following areas of activity:

- Capital management (financial management);
- Human resource management;
- Management by results;
- Information technology management.

The cumulative assessment of performance indicators in all four areas will allow, according to the authors of the methodology, to conduct comparative cross-national studies of the effectiveness of public administration. There are also Good Practices for Regional Performance Evaluation by the Government of Alberta, Canada (http://www.fmance.gov.ab.ca/index4.html) and the State of Virginia, USA (http://www.dpb.state.va.us/). A common methodology for assessing the comparative effectiveness of municipal government is "benchmarking with other bodies in similar functional areas" (Alfonso *et al.* 2023). An illustrative example of such a technique is a comparative analysis of the own activities of the administration of San Diego (USA).

However, when assessing the digital transformation of regional socio-economic systems, various sets of indicators are used that reflect the processes of digital transformation of the economy only partially. Since digital transformation is a complex concept that includes the relationship between business, government, and society, a system of interrelated indicators is required to quantify it. There is currently active work to promote indicative management based on signal and leading indicators as a tool for socio-economic policy (Filgueiras and Almeida, 2021).

A possible methodological approach is based on the use of a system of leading indicators presented as an integral indicator, which includes primary indicators characterizing the involvement of business, the state, and society in digitalization processes, that allows concluding in advance that digital transformations have taken place and that digital transformation has begun. Signal indicators also represent interval values of indicators that determine the level of digital development.

At the first stage, it is necessary to single out a set of leading indicators showing the interconnections of the digital development of the regional socio-economic system. Based on the selected set of leading indicators, neural network clustering should be carried out using self-organizing Kohonen maps in the Deductor analytical platform and the Matlab system. The main task facing the Kohonen network is to match groups that are close in value and combine them into clusters. In our case, this is a grouping in accordance with the level of digitalization of the regional socio-economic system. This point is very important, since the level of digital maturity can be very heterogeneous, which determines the need for a differentiated approach to assessing the effectiveness of public administration. For example, the level of digital maturity of European countries is shown in Fig. 3.

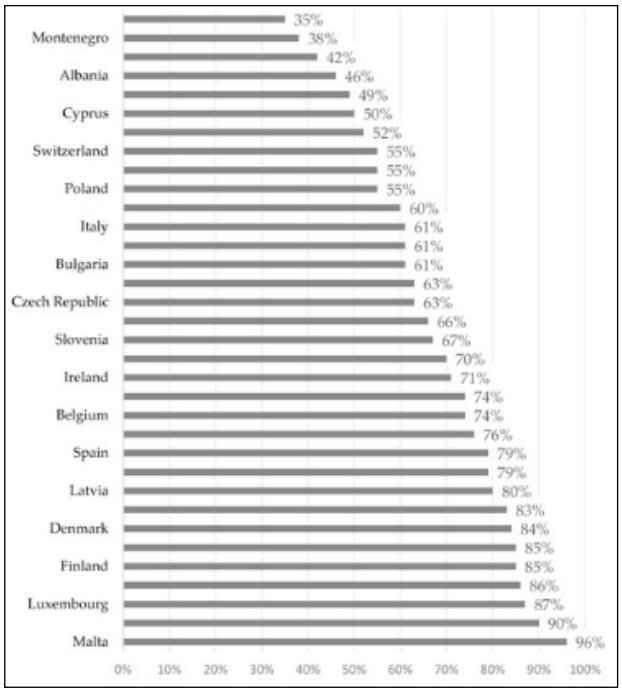

Fig. 3: The digital maturity of European countries (Krejnus *et al.* 2023)

As a result of the study, a graphical representation of cluster groups will be obtained, taking into account scaling, in relation to which it is possible to draw conclusions about the reference value, which in the future will enable making management decisions. Based on the data obtained, a trajectory of digital development of the studied regional socio-economic systems will be formed. At the second stage, based on the analysis of distances,

the scaling of the studied set of regions is carried out, groups will be obtained based on the signal indicator, showing the boundaries of the groups of regional socio-economic systems in terms of the level of digital development. The software used, created on the basis of neural network tools, will make it possible to form state regulation tools for each cluster group of regions aimed at stimulating digital development and reducing unevenness in the development of this process.

Thus, the proposed methodology for assessing the level of digital development, including leading and signal indicators, can be used in planning and forecasting the level of digital development of regional socio-economic systems and forming strategies for their development. At the same time, it is possible to analyze the results obtained in dynamics, which will allow not only to take into account the current level, but also to keep a record of changes for adequate and timely decision-making under conditions of uncertainty.

The use of indicative management tools based on the digital transformation mechanism at the stage of public policy implementation is intended to become an effective tool in relation to the associated costs of public policy. This implies an increase in motivation for the digital transformation of regional socio-economic systems. Further research is aimed at analyzing the dynamics of the level of digital development of regional socio-economic systems, the magnitude of the deviation of the values of this level from the reference, as well as developing directions for improving the mechanism for applying state regulation tools for digital transformation based on the results of an indicative assessment, taking into account the level of available resource potential and regional characteristics.

CONCLUSION

Digital transformation is a comprehensive transformation of the entire economic management system through the transformation of development strategies, marketing policies and goals, models, processes and operations, as well as products and services provided by the use of digital technologies, while digitalization is the improvement of existing processes through the introduction of ICT, reengineering and optimization technologies, as well as the use of Big Data analysis to make specific economic decisions. In the context of the digital economy and digital society, there is a paradigm shift in many concepts, including the concept of assessing the economic efficiency of public administration. Just a cost analysis of the effectiveness of the development of budgetary funds is not sufficient in today's conditions. It is necessary to analyze the complex socio-economic effect, in the regional context, due to the heterogeneity of the digital development of the regions in many, even the most advanced, countries. At the same time, the comparability of indicators can be ensured by normalizing them using relative values.

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